Clemson IPM Program Newsletter

October 2021 Issue #5

Integrated pest management is an ecologically-based approach to managing pests with an emphasis on using multiple management strategies. The principles of IPM can be applied to any pest of food or fiber production systems, landscapes, and urban environments. IPM considers multiple control tactics with the aim of minimizing selection pressure on one given tactic.

The Clemson IPM program (https://www.clemson.edu/extension/ipm/index.html) seeks to increase adoption of IPM practices in South Carolina by developing interdisciplinary, research based information, and providing it to the public in efficient and accessible formats. The goals of the IPM program are driven by the needs of stakeholders, who have an integral part in developing the priorities of the current program.

The Clemson IPM Newsletter will provide updates on research, extension programs, successes in IPM, important dates, and more!

@IPM_Clemson

Follow the Clemson IPM program on Twitter for real time updates throughout the growing season

Meet the Team

The IPM program at Clemson is comprised of the coordination team, extension personnel, and researchers throughout the state.

Pee Dee REC
Francis Reay-Jones, *Field Crop Entomology*
JC Chong, *Specialty Crop Entomology*
Joe Roberts, *Turfgrass Pathology*
Ben Powell, *Pollinator Specialist*

Coastal REC
Tony Keinath, *Vegetable Pathology*
Matt Cutulle, *Vegetable Weeds*
Brian Ward, *Organic Vegetable*

Edisto REC
Jeremy Greene, *Field Crop Entomology*
Mike Marshall, *Field Crop Weeds*
Dan Anco, *Peanut Specialist*
John Mueller, *Field Crop Pathology*

Clemson Main Campus
Guido Schnabel, *Fruit Crop Pathology*
Juan Carlos Melgar, *Pomology*
Steve Jeffers, *Ornamental Crop and Tree Pathology*

UGA, Athens
Brett Blaauw, *Peach Entomologist*

Coordination Team
Francis Reay-Jones, *Program Coordinator*
Tim Bryant, *Associate Program Coordinator and Newsletter Editor*

Tell us what you think...

Please take a few minutes to fill out this survey to tell us what you would like to see in future editions of this newsletter!

Partial support for the Clemson IPM Program is provided by funding from the USDA NIFA Crop Protection and Pest Management Extension Implementation Program.

Managing an Important Pest of Leafy Greens

Contributing Author: **Dr. Tony Keinath**

Downy Mildew sporulation on the underside of a collard leaf. Right; Yellow lesions seen on upper surface of infected kale leaf

Downy mildew, caused by the fungus-like oomycete Hyaloperonospora parasitica, is an important disease of leafy brassicas (i.e. collards and kale) in South Carolina. Plants can be infected anytime throughout the growing season, but downy mildew is favored by cool, wet weather and fog that makes it particularly important in winter/ early spring crops.

Symptoms of infection are angular yellow and tan spots on collards and yellow and black spots on kale. In both crops, when downy mildew is active, white masses of spores can be seen on the under sides of leaves directly under the necrotic spots seen on the upper side of the leaves. Downy mildew is spread when wind or rain splash carries spores from the white spots on the undersides of leaves to new plant material to infect.

Dr. Tony Keinath, a vegetable pathologist at Clemson's Coastal Research and Education Center, is testing a range of organic and conventional fungicides for post-detection management of downy mildew in leafy brassicas.

Collards and kale were transplanted into the field on February 19, 2020, surrounded by border rows planted the previous November which served as a source of inoculum for the test plots. A range of different fungicides were then applied weekly beginning on April 3 through April 24. Fungicides included Zampro 525SC (ametoctradin & dimethomorph), ProPhyt 4P (potassium phosphite), Presidio 4SC (fluopicolide), Badge X2 (copper oxychloride & copper hydroxide), Stargus (Bacillus amyloliquefaciens), and water served as a control.

Once harvested, leaves were classified as either marketable or diseased, counted, and weighed. In South Carolina kale growers practice a zero tolerance for black spots, so any visible symptoms were categorized as diseased leaves. Overall disease incidence in this study on marketable leaves was relatively low, compared to the disease incidence on plants early in the study. Despite the low disease pressure some differences in the efficacy of the fungicides tested were still found.

On both crops, Zampro, ProPhyt, and Presidio increased the percentage of healthy leaves compared to the control. Badge also increased healthy leaf tissue but only on collard and not on kale. Stargus was not found to be effective in this trial, however it could be more effective if applied prophylactically as opposed to post-disease outbreak as it was used in this study. Badge X2 was the only effective organic treatment tested in this trial, however it only improved the percentage of healthy tissue in collard. While many of the fungicides increased the amount of healthy tissue, no treatment program improved the yield (weight of healthy leaves) in this trial.

While this study... (cont. page 3)

Kale harvest from plants treated with Prophyt, diseased leaves are on the left and healthy leaves on the right.

provides valuable fungicide program insight for both conventional and organic growers, consideration should still be given to additional non-chemical control strategies each season. Cultural control options include incorporating crop residue into the soil, rotating with non-host crops, and limiting moisture particularly when seedlings are transplanted. In the fall, downy mildew usually starts after foggy mornings, so fog can be used an indicator of when to start fungicide applications. Consideration of all these strategies to limit disease development and an effective fungicide program like some of those studied this year is a strong basis for integrated management of downy mildew in leafy brassicas.

On-Going Research Provides Valuable Insight on the Use of Transgenic Sweet Corn for Managing Corn Earworm

Contributing Author: **Dr. Francis Reay-Jones**

Corn earworm is the most common and significant pest of sweet corn in South Carolina. Feeding by the insect can result in severe reduction in the marketability of damaged ears. Eggs are laid directly on the silks and, once larvae hatch, they quickly move down the silks to feed on the developing ear. After larvae reach the ear, management can be very difficult as they are protected from direct contact with insecticides. The most common method of management involves spraying a contact insecticide weekly while ears are silking to prevent establishment of larvae. This management strategy is costly for growers, results in a larger environmental impact, and ultimately can be ineffective if timed poorly.

One alternative to conventional insecticide use for corn earworm management is Bt technology. Bt sweet corn hybrids are genetically modified to express natural toxins that are effective for managing corn earworm as well as a number of other lepidopteran pests. Bt insecticide sprays have been used in both conventional and organic agriculture for decades. Transgenic Bt corn technology has been commercialized since 1996. While the use of transgenic Bt technology is widespread in cotton and field corn in South Carolina, the use of Bt sweet corn hybrids is less common, partly due to consumer acceptance of genetically modified crops.

Non-Bt sweet corn (left) with corn earworm damage vs a Bt hyrbid (right)

Currently Dr. Reay-Jones, entomologist at Clemson University's Pee Dee Research and Education Center, is examining...(cont. page 4)

 

Left; research plots with different Bt sweet corn hybrids. Right; Dr. Reay-Jones examining different Bt sweet corn hybrids for their efficacy in managing corn earworm

the efficacy of several Bt sweet corn varieties for managing corn earworm. This is part of multi-state effort led by the University of Maryland that involves similar trials conducted from Canada down to Georgia that aim to assess the long-term susceptibility of corn earworm to several Bt toxins. Bt sweet corn hybrids are used as sentinel plots to detect potential resistance to Bt toxins by examining trends across a broad geographical area over a long period of time.

There are several commercially available sweet corn hybrids expressing different Bt toxins that are marketed as Attribute I (expressing Cry1Ab), Attribute II (Cry1Ab and Vip3A), and Performance series (Cry1A.105 and Cry2Ab2). For all the toxins listed, some level of resistance has already been documented in corn earworm populations in many parts of the U.S., including in South Carolina. Managing further development of resistance is an important consideration with increased adoption of Bt technology, and is particularly important when trying to delay the development of resistance to newer traits like Vip3A. The majority of field corn and cotton grown in the corn and cotton grown in the U.S. is transgenic, and express the same or very similar Bt toxins as these sweet corn hybrids, with the Vip3A toxin also being the only toxins providing excellent control of the insect in field corn and cotton, where it is known as bollworm.

"Bt sweet corn is a particularly well-suited crop for sentinel plots to detect resistance in corn earworm," says Reay-Jones, "Sweet corn is a very attractive crop for corn earworm moths, and Bt toxins are expressed at higher levels than in Bt field corn. Also, harvest of sweet corn is conducted earlier in the season than in field corn, which means there is less of an opportunity for corn earworm to feed on senescing tissue that may have lower levels of Bt toxins. This project also provides a tremendous opportunity to participate in an exciting project with a broad network of collaborators. In addition, this project provides important management information for sweet corn growers in South Carolina."

In field corn, there are refuge planting requirements mandated by the EPA to manage the development of resistance. The refuge planting strategy requires planting non-Bt corn hybrids in blocks or strips in or nearby Bt corn fields. This allows for moths that developed on the refuge to mate with any potential resistant moths that developed on the Bt crop, which will help to dilute resistance genes in the population. Because sweet corn represents such as small proportion of corn planted in the U.S., sweet corn is exempt from a non-Bt refuge requirement. As such, the importance of complying with refuge requirements in field corn is a necessity to delay resistance in corn earworm for both Bt corn, Bt sweet corn, and Bt cotton.

Bt sweet corn provides an additional management tool for corn earworm that can help to reduce the environmental impact of controlling this pest. However, as is the case with insecticide use, Bt technology must be used responsibly with respect to resistance management. For more information on sweet corn insect pest management see this article from [Clemson's Home and Garden Information Center] or contact your local extension agent.

Cultivar Selection Plays a Critical Role in the Management of a Damaging Disease of Watermelon

Contributing Author: **Dr. Tony Keinath**

Left: Above ground symptoms of fusarium wilt six weeks aftertransplanting. Right; Joy Ride, a fusarium wilt susceptible cultivar, on the left and Fascination grafted to Carolina Strongback rootstock, a highly resistant cultivar, on the right six weeks after tranplanting.

Fusarium wilt, caused by the fungus Fusarium oxysporum, is an important vascular disease of watermelon which can cause significant yield loss under the right conditions. When infected, leaves will wilt and vines will decline. Often one side of the plant will display more severe symptoms then the other, which can help to identify the disease as fusarium wilt. To confirm the presence of fusarium wilt, the crown of the plant can be cut open and infected plants will have brown streaks in the xylem. Infections are often introduced from the soil so disease presence can be patchy and random throughout an infected field.

The primary source of inoculum for fusarium wilt is infected plant material, soil, and/or seeds. Once fusarium wilt is present in a field, however, it can produce spores which survive for 5-10 years in the soil and can infect future plantings when conditions are favorable. Cool and wet conditions in the spring favor the development of disease in young watermelon plants, but disease symptoms are often not seen until hot and dry conditions stress the plant later in the season.

Fusarium wilt can be difficult or impossible to manage with fungicides as the disease is located in the vascular tissue of the plant and thus protected from contact with fungicides. The visual symptoms of infection also present long after the infection occurred, further complicating the timing of fungicide use. Due to the limitations on fungicide use in managing this disease, it is critical to establish a cultural control program which limits the amount of disease material in the field, and implements the use of a resistant watermelon cultivar.

Dr. Tony Keinath, a vegetable pathologist at Clemson's Coastal Research and Education Center, conducted experiments in 2021 to test the susceptibility of several different watermelon cultivars to fusarium wilt, and wilt effect on watermelon yield and quality.

The cultivars tested included Shoreline, Joy Ride, El Capitan, Sierra Nevada, Tri-X-313, Fascination, 7197HQ, Powerhouse, Embasy, and Fascination grafted to the rootstock Carolina Strongback. The intensity of fusarium wilt disease was recorded during the growing season, and the marketable weight, number of watermelons, Brix (sugar content of the watermelon), and watermelon firmness were recorded at harvest.

There was a significant difference amongst the cultivars in the intensity of disease that developed. Fascination grafted to Carolina Strongback...(cont. on page 6)

rootstock had no disease develop, and Embassy had very little. Shoreline and Joy Ride had the most disease of all the cultivars tested.

There was a significant negative relationship between the severity of disease and the marketable weight and marketable number of watermelons. This means that as the disease severity increased, the overall yield decreased significantly illustrating the importance of selecting a resistant cultivar in managing fusarium wilt. Brix, or the percentage of soluble sugar in the fruit, was not associated with disease severity.

This study provides clear evidence for the importance of cultivar selection in managing a damaging disease of watermelon. Along with ensuring disease free plant material is planted and sanitizing soil, cultivar selection is the primary method of preventing loss for growers.